

construction would confer greater sensitiveness, and it is probable that this method of observation can be advantageously applied in the construction of instruments for measuring moderate currents. It is, however, evident that this form of the electro-dynamometer is particularly suitable for *large* currents. We have

$$S : S' :: \sqrt{w} : \sqrt{w'}$$

That is, as the current increases, the corresponding weights increase more rapidly and greater accuracy and minuteness are attained.

Thus, as the instrument I have experimented with has been arranged, a current of

20 webers requires a weight of	530 mg.
21 "	580 " diff. 50 mg.
49 "	3,165 "
50 "	3,295 " diff. 130 mg.
80 "	8,230 "
81 "	8,440 " diff. 210 mg.

while a difference of 10 mg. is sharply indicated.

My best thanks are due to Prof. John Trowbridge, of Harvard, for advice and the use of his apparatus.

#### NOTES

THE Committee appointed by the French Minister of Public Instruction has awarded the *Prix de Volta*—50,000 francs—to Graham Bell

A TRANSLATION of "The Skies and Weather Forecasts" of Aratus, by Mr. E. Poste, M.A., of Oriel College, Oxford, will shortly be published by Messrs. Macmillan and Co. These poems, apart from a certain charm in the treatment of the subject, are not without interest as belonging to the literature of infant astronomy and infant meteorology. The meteorology of Aratus is of course merely a specimen of the popular weather wisdom of his day. But the faith it shows in the possibility of a science, and the sense of the importance of such a science, gives him a certain claim to the attention of modern scientific men. The notes to Mr. Poste's translation will be addressed merely to novices in astronomical knowledge.

THE *New York Times* announces the death at Waukegan, Ill., on January 6, of Mr. James W. Milner, at the age of thirty-nine. When barely arrived at man's estate he travelled through Minnesota and the adjoining States, engaged in making collections. At Waukegan Mr. Milner made some remarkable discoveries in the peat-beds, and the remains of an elk which he exhumed were exhibited for quite a number of years in the Chicago Academy of Sciences, until they were destroyed by fire. Such papers as Mr. Milner had written on these remains and on other topics of a similar character, from their singular terseness and excellence, attracted the attention of the Smithsonian Institution. A correspondence, ensuing between the Smithsonian and Mr. Milner eventually led to his engagement by the present secretary, Prof. Spencer F. Baird, and, in 1871, Mr. Milner was appointed Deputy United States Fish Commissioner, with the particular duty of studying the habits, food, method of breeding, and catching of the white-fish. From these labours in what some six or seven years ago was quite unknown ground, resulted a work of the most thorough and exhaustive character, which may be cited as a model of patient and elaborate research. From the period of his entrance into the United States Fish Commission his labours were incessant. In the study and development of practical fish-culture, as understood in its widest sense, Prof. Milner may be said to have done more for it than any one else in the United States. His ingenuity and adaptiveness, combined with his thorough grounding in natural history, permitted him to solve many things in fish culture which before his time had been as problems. The wonderful successes he achieved soon made him a leading authority on these subjects, both at home and abroad.

THE death is announced, at the age of sixty-three years, of Mr. David Thomson, Professor of Natural Philosophy in the University of Aberdeen.

M. WALFERDIN, the inventor of the minimum thermometer, died at Paris at the end of January at the age of eighty-five, after a protracted illness of many years' duration. He was one of the members of the Constituent Assembly of 1848. Since that time he devoted all his leisure to scientific and artistic pursuits. He collected almost every picture drawn by Fragonard, one of the most celebrated French artists of the end of the eighteenth century. He sold his gallery to an English nobleman about twenty years ago, on condition that he should be appointed during his lifetime keeper of the gallery, with a salary of 500*l.* a year, and that the gallery should be exhibited at his own rooms. This precious collection will shortly come to England.

WE regret to state that General Morin, the well-known director of the Conservatoire des Arts et Métiers, is lying in a very precarious state in consequence of a severe cold. Great anxiety is felt for him at the Institute, of which he is one of the most respected and popular members. The General is aged eighty-five years.

ON Monday Prof. W. K. Parker, F.R.S., commences a series of nine lectures at the Royal College of Surgeons, on the Structure and Functions of the Vertebrate Skeleton, to be continued on Mondays, Wednesdays, and Fridays, to the 27th inst. Prof. Flower, in continuation of previous courses, begins his series of nine lectures on the Comparative Anatomy of Man, on March 1, to be continued as above to March 19.

WE are glad to learn that the College of Surgeons have seen their way to the purchase of the Barnard Davis Anthropological Collection, and that Prof. Flower is superintending the removal of the collection to the museum of the College.

THE death is announced of Sir Dominic Corrigan, the well-known Dublin physician, at the age of eighty years.

ON Tuesday afternoon the problem set by the accidental explosion of the 38-ton gun on board the *Thunderer* was solved by the explosion of the sister gun with a double loading. The gun was carefully loaded, and then a diagram was painted outside the gun showing the positions of the two charges and their projectiles. First was rammed home the Palliser cartridge of 110 lbs. of pebble powder, next the Palliser shell of 110 lbs., and the papier-mâche wad. The second charge followed—namely, 85 lbs. of powder, a common shell, and another wad, and the double loading was complete. As marked on the outside of the gun, the 85 lbs. of powder lay just in the position where the gun swells in thickness to strengthen the powder chamber. After the firing the little dark cell was found strewn with fragments of the gun, the breech end only of which remained on the carriage, resembling with marvellous fidelity its unfortunate companion now exhibited in the Royal Gun Factories.

WE notice in the January number of the *Archives des Sciences Naturelles* an interesting letter by Col. Ward, on the meteorology of the high regions of Switzerland during December last. Whilst the valleys were covered with a thick fog, and the sun was visible only for very short intervals, bright sunshine glowed about Rossinières (a small town close by Chateau d'Oex, altitude about 3,240 feet); here the sun was seen daily for twenty-seven days, and twenty-one days were absolutely cloudless. On December 25 Col. Ward climbed Mont Cray, a mountain 6,793 feet high, situated between Rossinières and Châteaux d'Oex. The view from the top was never so clear and wide; it reached as far as seventy miles in each direction; the mountains of Lake Constance, the Bernese Oberland, Monte Rosa, Mont Blanc, the Vosges, and even the Black Forest, were quite distinguishable, as well as the plateau north of Mont Cray, with the towers of Friburg and Romont. On the contrary, a thick fog covered

Lakes Geneva, Neuchâtel, Morat, and Biel, and the neighbouring valleys. The quite level surface of this fog is likened to that of a sea of milk which reached as high as 500 feet beneath the 4,900 feet high Col de Jaman. At Rossinières the planet Venus was seen with the naked eye in daylight from October 23 until the end of December.

ANOTHER interesting note, by Prof. Plantamour, inserted in the same number of the *Archives*, deals with the temperature of the St. Bernard. It happens every year that the temperature on the St. Bernard, during several hours, or even during several days, of December, is higher than at Geneva. But during December, 1879, this anomaly lasted for a far longer period of time than usual; the average temperature of December on the St. Bernard (2,070 metres above Geneva) was 8°.4 Celsius higher than at Geneva; out of the thirty-one days of the month only during fourteen days was it from 0°.04 to 6°.2 Celsius lower than at Geneva, whilst during seventeen days it exceeded this by 2° to 16°.4 (16°.4 on December 1, 13° on December 5, 7, and 31; 11° on the 8th, 13th, and 30th, and so on). Prof. Plantamour observes also how difficult it is in such cases to determine the mean temperature of the stratum of air between the two stations, and how great the error of the barometrical levelling and of the reduction of the observed pressure to the sea-level would be if we applied the barometrical formula to such cases when the usual distribution of heat is inverted as it was during December last. As to the temperature at Geneva, it was, during this month, 6°.9 Celsius lower than the average for fifty years; this difference exceeded four times the probable difference which, when deduced from fifty years' observations, is only ± 1°.72, the probability of such a difference being only 0.005.

THE results of a recent instructive experiment in sylviculture, extending over seventeen years, have been communicated to the French Academy by M. Gurnaud. His conclusions are as follows:—(1) That light when it strikes the ground, after being sifted in the foliage, stimulates the production of carbonic acid in the decompositions which produce humus, and also the decomposition of that gas by the green parts. (2) That the growth of tall trees is retarded, though their green parts expand freely in the atmosphere, under direct impression of the luminous rays, when the lower covert formed by trees of smaller size intercepts too completely the access of light to the ground, and diminishes its reflex action on the tops of the tall trees. (3) That the covert formed by underwood weakens this reflex action of light on the vegetation of tall trees rather by its composition, than in any other way; since, after a clearing which suppresses the oblique shoots, the vertical shoots retained do not offer any obstacle. (4) That humus, under too dense a covert, loses a part of its efficacy, and herein resembles farm-dung, which, too deeply buried, remains inert for several years. *En résumé*, it is demonstrated how the vegetation of tall trees may be improved by operating on the composition, consistence, and duration of the underwood.

A CORRESPONDENT of the *Times* writing from the Royal Mail Steamer *Para* at sea, January 17, records a volcanic eruption in the Island of Dominica, and also disastrous floods in St. Kitts. On Sunday, January 4, at 11.5 a.m., the inhabitants of Roseau, the capital of Dominica, a town situate on its western shores, were suddenly plunged into almost total darkness, for, although it had been raining heavily all the morning, the sky up to half-past ten was fairly clear, and there was no warning of what was to come except a strong smell of sulphur pervading the atmosphere, and this, in an island abounding in sulphur springs, is so usual that few of the inhabitants had even noticed it. With the strange darkness came torrents of milk-white water, mixed with black volcanic sand and ash, flashes of bright red lightning, peal after peal of thunder, while ever and anon between the peals could be heard a strange subterranean

noise like the breaking of waves on a lee-shore. This lasted nearly fifteen minutes. When daylight was restored the town was found to be covered with ashes an inch deep, and the surrounding country presented a most abnormal appearance. The cause of this strange volcanic phenomenon did not long remain a mystery, for next morning, during a lull in the deluge of rain, there could be seen hanging over the "Boiling Lake" crater, and in clear outline against the sky, a cloud such as the younger Pliny describes as having hung over Vesuvius in August, 79, of our era. The now famous "Boiling Lake" of Dominica is the centre of a large crater in the southern extremity of the island, called the Grand Souffrière Hills. During the eruption nearly all the rivers in the island overflowed their banks, and in the Point Mulâtre River, which rises from the crater of the "Boiling Lake," all the fish, even those near to the estuary, died, and were subsequently taken out in basketfuls by the natives. The flood in St. Kitts occurred on Sunday, January 11. The storm began about 10 P.M. with heavy rain, which gradually increased in intensity until midnight, when it almost seemed to be rain, and seemed to assume the character of a falling waterspout. During this time there were occasionally strong blasts of wind, very vivid lightning, and once or twice a tremulous undulating movement of the earth. There was, however, only one severe shock, and it is said to have occurred about 2.30 A.M. on the 12th, when the full fury of the storm was attained. After this it began to decrease in violence, and at 4.30 all was silent, and the work of destruction was over.

AN international exhibition of plants and flowers will be held at Weisbaden during the approaching summer.

AT Geneva an international exhibition of clocks and watches, and of all machines, implements, utensils relating to clock making, will be held during May and June next.

ICE-BLOCKS have been formed not only at Saumur but also at Lyons. These occurrences are not unexampled, as it appears that in the terrible winter of 1840 the Vistula was also blocked by ice, close to Dantzig; the result was that the stream opened a new bed in a sandy and hilly ground. The channel for preventing the level of water rising higher than the top of the embankments has been bored by explosions in the Saumur iceberg. The work was begun on the 16th and was ended on the 22nd. The section is from 10 to 20 metres. Since that time the engineers have been busy enlarging it, and the work is progressing favourably. The iceberg has been measured carefully, and estimated at 15,000,000 cubic metres. The navigation arm, on the right side, has been hopelessly blocked, and no work has been tried. The weather is splendid, the sun extremely hot during day, but the nights are very cold. On Tuesday morning all the streets were covered with ice.

IT has been noted that during the present weather crisis the Montsouris electrometers have shown not a single negative reading. This positive state has continued for the last three months. The readings are taken eight times a day.

THE recently opened Albert Institute at Windsor made a good beginning on January 20 with an interesting lecture by Mr. F. Drew, of Eton, on "The Objects aimed at by the Institute." Mr. Drew showed the great interest attaching to the study of the various branches of science, giving some useful practical hints as to how the study both of science and of literature may be most effectively carried out.

WE notice a useful Russian work by M. Tchikoleff, on "The Electric Light and its Applications to Military Purposes," being a thorough description, with numerous figures of the various apparatus employed in the armies of various countries.

MR. GORDON HOLMES's work on "Vocal Physiology" is not published at Edinburgh, but by Messrs. Churchill, of London.

THE additions to the Zoological Society's Gardens during the past week include a Feline Douroucouli (*Nyctipithecus vociferans*) from Brazil, presented by the Right Hon. H. Hugh Childers, M.P.; an Ocelot (*Felis pardalis*) from British Guiana, presented by Mr. G. Whitmore Christie; a Little Grebe (*Podiceps minor*), British, presented by Mr. Thos. Edward Pryce; five Undulated Grass Parrakeets (*Melopsittacus undulatus*) from Australia, deposited; a Black Lemur (*Lemur macaco*) from Madagascar, a Tamandua Anteater (*Tamandua tetradactyla*) from Brazil, purchased.

#### OUR ASTRONOMICAL COLUMN

SOLAR PARALLAX FROM THE VELOCITY OF LIGHT.—Mr. D. P. Todd, of the *American Nautical Almanac* Office, publishes an interesting note upon this subject. Remarking that the opposition of Mars in 1862, when the planet approached near the earth, and the experimental determination of the velocity of light in the same year, mark the beginning of a new era in the history of the determination of the solar parallax, he refers to the many values of this constant which have since been worked out, and the fact that although theoretically the better class of these determinations should yield values in consistent harmony with each other, there are at present singular and unaccountable discordances. Prof. Newcomb's mean value of the parallax,  $8^{\circ}848$ , he observes, was regarded with caution only because it was considered too small, the researches of Hansen, Leverrier, Stone, and Winnecke appearing to place the parallax considerably outside Newcomb's value. Within the last two or three years, however, Mr. Todd remarks that "the parallactic pendulum has swung quite to the lesser extremity of the arc until the true value of the solar parallax has appeared possibly below  $8^{\circ}8$ , and that, too, with good reason." But now there seems to be a slight gravitation towards a central value, and he thinks it is not possible to say that the mean equatorial horizontal parallax of the sun is so much as the hundredth part of a second different from the old figure,  $8^{\circ}813$  ( $27''2$  centesimal) adopted by Laplace in the *Mécanique Céleste*, and resulting from the early discussions of the transits of Venus in 1761 and 1769.

Fizeau made the first experimental determination of the velocity of light in 1849, but the earliest which can lay claim to the merit of trustworthiness is that of Foucault in 1862, who found it 298,000 kilometres per second, expressing confidence in it to about one-six-hundredth part, though Mr. Todd estimates the probable error twice as great. Next we have the first determination by Cornu, detailed in the *Journal de l'École Polytechnique*, 1874, which is 298,500 kil.  $\pm 1,000$ . The second determination by Cornu, related in the *Annales de l'Observatoire de Paris*, t. xiii., 300,400 kil.  $\pm 300$ ; Helmholtz's rediscussion of these experiments in 1876 assigns 299,990 kil., the probable error of which value Mr. Todd estimates at 200 kil. Then follow two determinations by Mr. A. A. Michelson, U.S. Navy, to the first of which, 300,100 kil., he assigns equal weight with the earlier value of Cornu; the second, briefly described in the *American Journal of Science* for November, 1879, Mr. Todd interprets, giving equal weight to the one hundred separate determinations, to imply a velocity of 299,930 kil.  $\pm 100$ . Assigning weights to these various values, he finally deduces for the velocity of light, 299,920 kilometres, or 186,360 miles per second.

The next step for the determination of the distance of the sun from the earth is the combination of this value with astronomical constants: (I.) Theory and observation of Jupiter's satellites afford a result of the interval of time required by light in traversing the mean distance of the earth from the sun, but there are only two precise determinations of this interval, astronomically speaking; the first by Delambre in his Tables of the satellites, which was also adopted by Damoiseau in his later tables, published in 1836, the second by M. Glasenapp, of the Observatory of Pulkowa, in 1874, from twenty-five years' observations of the first satellite of Jupiter, ending in 1873; the values are respectively  $493^{\circ}2s.$ , and  $500^{\circ}84s. + 1^{\circ}02s.$ ; the latter value rests upon a much smaller number of observations than Delambre's, but Mr. Todd remarks that it is difficult to form a just estimate of the worth of an average observation of an eclipse of a satellite of Jupiter in the last century, and moreover, we have not the means of knowing the process of discussion followed by the French astronomer; he combines the result by giving double weight to Glasenapp's result, which depends upon observations of definite excellence, discussed with modern precision, and thus adopts  $498^{\circ}3s.$  for the

time-interval required for light to reach the earth from the sun at her mean distance; he then combines the distance thus obtained with the value of the equatorial radius of the earth derived by Listing ("Neue geometrische und dynamische Constanten des Erdkörpers," Gottingen, 1878), and there results for the mean equatorial horizontal parallax of the sun  $8^{\circ}802$ .

(II.) The velocity of light, the constant of aberration, the eccentricity of the earth's orbit, and the earth's mean anomaly, are connected by an equation which Mr. Todd employs for a further determination of the solar parallax, adopting for the constant of aberration Struve's value ( $20''4451$ ), with Listing's value of the earth's equatorial radius, and by this process the sun's parallax is found to be  $8^{\circ}811$ . Duly weighing the probable variations of the elements which enter into these computations, Mr. Todd concludes that the experimental determinations of the velocity of light hitherto made, give, when combined with astronomical constants, the mean equatorial horizontal parallax of the sun =  $8^{\circ}808 \pm 0^{\circ}006$ , and hence the corresponding mean radius of the terrestrial orbit = 92,800,000 miles.

FAYE'S COMET.—Although, as lately remarked in this column, the only known comet of short period which will be actually in perihelion during the present year is that discovered by Prof. Winnecke in 1858, Faye's comet will arrive at its least distance from the sun in January, 1881, and may be observed during the last half of 1880. Thanks to the admirable investigations of Prof. Axel Moller, the theory of Faye's comet is known with such precision that the ephemeris for the approaching reappearance, which he communicated to the Swedish Academy in September, 1878, and which has been reproduced in the *Astronomische Nachrichten*, may be expected to deviate in a very slight degree only from the truth, and the comet's discovery will be simply a test of the optical capacity of the telescope. Prof. Axel Moller commences his ephemeris on July 1, 1880, and continues it to the end of the year. On July 1 the theoretical intensity of light is  $0^{\circ}04$ , about equal to that at the date of the last observation with the 15-inch refractor at Pulkowa in 1844, and the comet in about R.A. 23h. 6m., Decl. +  $8^{\circ}$ , may be then observable. The maximum intensity will be attained about the middle of October, and will be about the same as at the last observation in 1858 with the 9-inch refractor at Berlin, or  $0^{\circ}21$ ; at the end of the year the intensity of light will have diminished to  $0^{\circ}14$ . Thus the comet will be always faint, nor does it appear likely to present itself under the favourable circumstances attending its first appearance in 1843 for several revolutions yet to come.

#### GEOGRAPHICAL NOTES

By a postscript to the February number of the Geographical Society's periodical we learn that a telegram has been received from Mozambique, announcing the arrival of the East African Expedition at Lake Tanganyika on October 28; the distance from Lake Nyassa was found to be 250 miles, the country level, and the people friendly. Mr. Thomson's account of his journey from Dar-es-Salaam to Uhehe is given in the present number, and his notes of the route, though necessarily somewhat rough, will afford useful material for filling up a blank in the map of East Africa. We have also Mr. Wilfrid S. Blunt's description of his visit to Jebel Shammar (Nejd), and his journey through Northern Arabia, of which he gave but an outline at a recent meeting of the Society. The paper is illustrated by two maps, one of which is a sketch map of Jebel Shammar furnished by Mr. Blunt. Among the geographical notes is an interesting account of Norwegian exploration last year in the Spitzbergen seas, which appears to have hitherto escaped notice in this country. Under the head of obituary we find brief notices of Major Herbert Wood, R.E., and Mr. Hepworth Dixon, while the remainder of the number contains the usual routine matter.

ACCORDING to the *Colonies and India*, Mr. Mitchinson, who has travelled much among the natives of nearly all parts of Africa, and especially in Berguela, Ovampo-, and Darnara-lands, &c., states that he saw there wild beasts which had been tamed entirely by the natives, although they are usually supposed never to attempt it. On the River Cunene he found two perfectly tame cow hippopotami, which were not confined in any way, but always returned to the village. In a neighbouring place Mr. Mitchinson also saw an African elephant which had been tamed, and was entirely under control. This certainly goes to show that the